

The US-CUORE Collaboration

An neutrionless double beta decay
experiment at the Gran Sasso Lab.

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3. *LLNL*

4. *UC Berkeley*

5. *UCLA*



Physics



Next generation $0\nu2\beta$ experiments potentials:

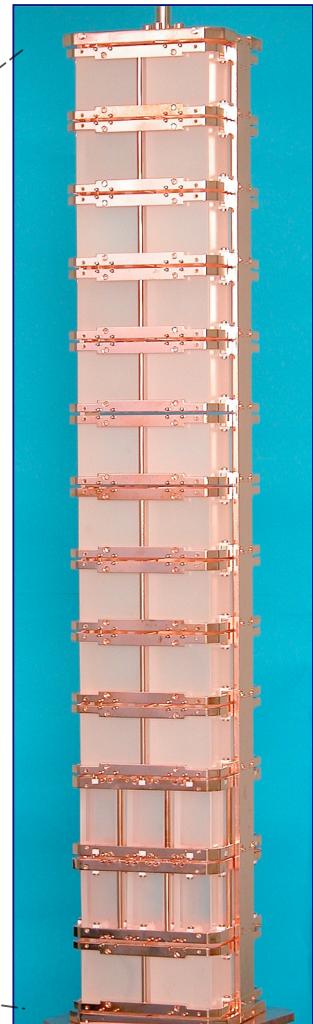
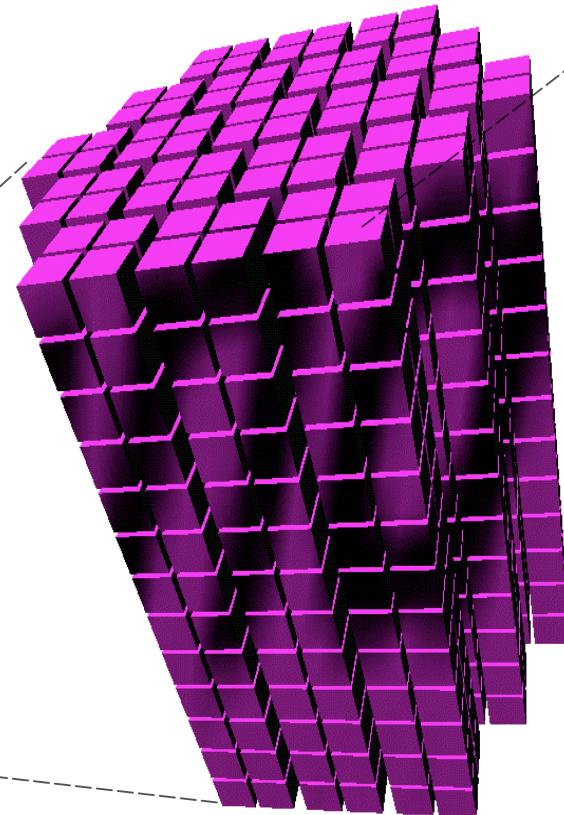
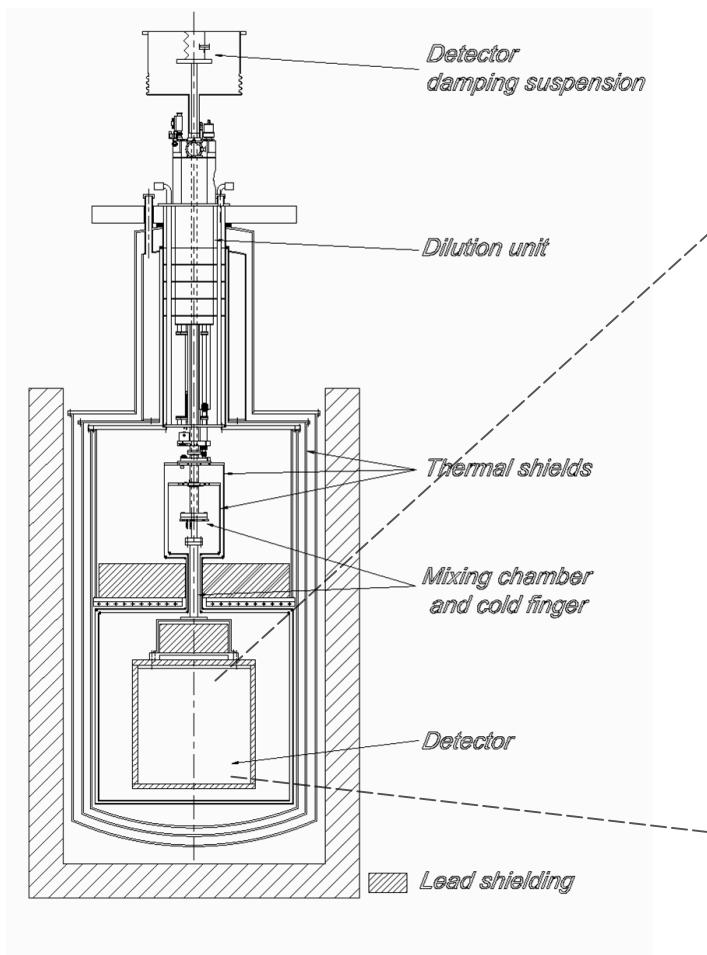
- Rule out(in) inverted hierarchy scenario, based on today's model limit.
- Discover neutrino nature.
- Determine neutrino mass.



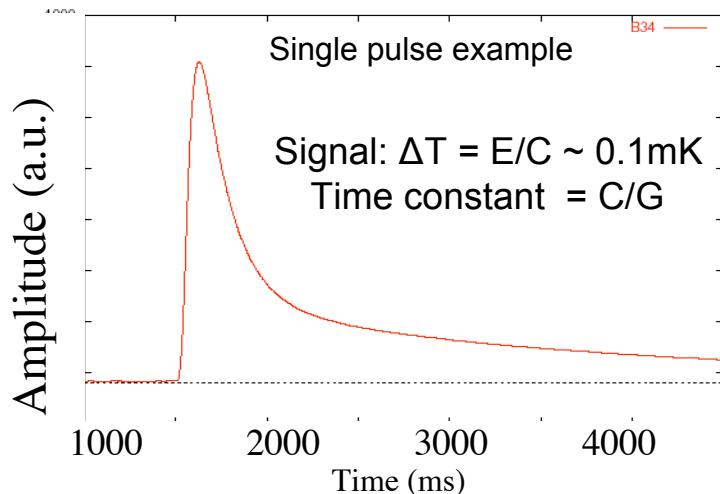
CUORE/CUORICINO



CUORE starts data taking in 2009
<http://crio.mib.infn.it/wig/Cuorepage/ CUORE.php>



Cryogenic Bolometers



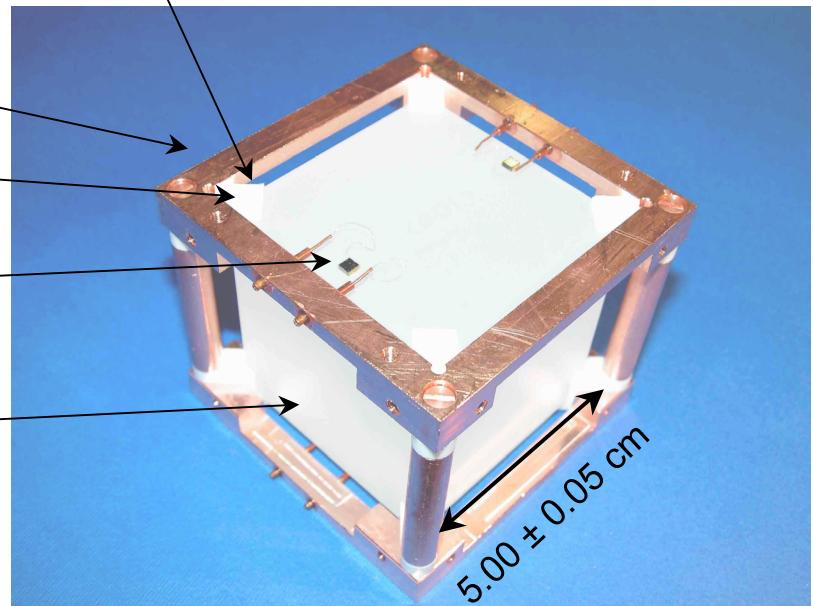
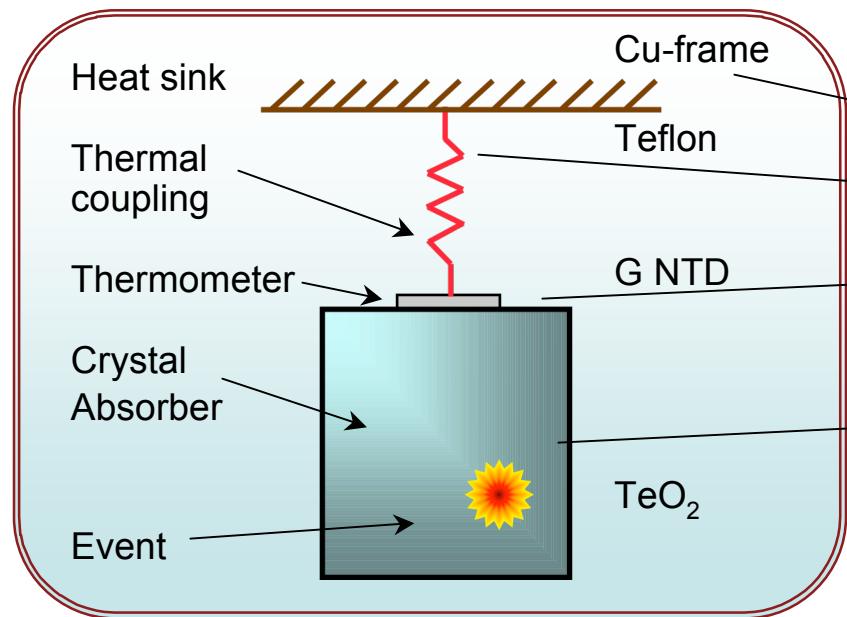
TeO₂ Crystals:

- Dielectric diamagnetic materials
- Low temperatures ($\sim 10\text{mK}$)
- Low heat capacity:
 $C \sim 2\text{ nJ/K} = 1\text{ MeV / }0.1\text{ mK}$



Teflon

$$G = 4\text{ pW/mK}$$





Experimental methods



Fermi's golden rule

Measurements

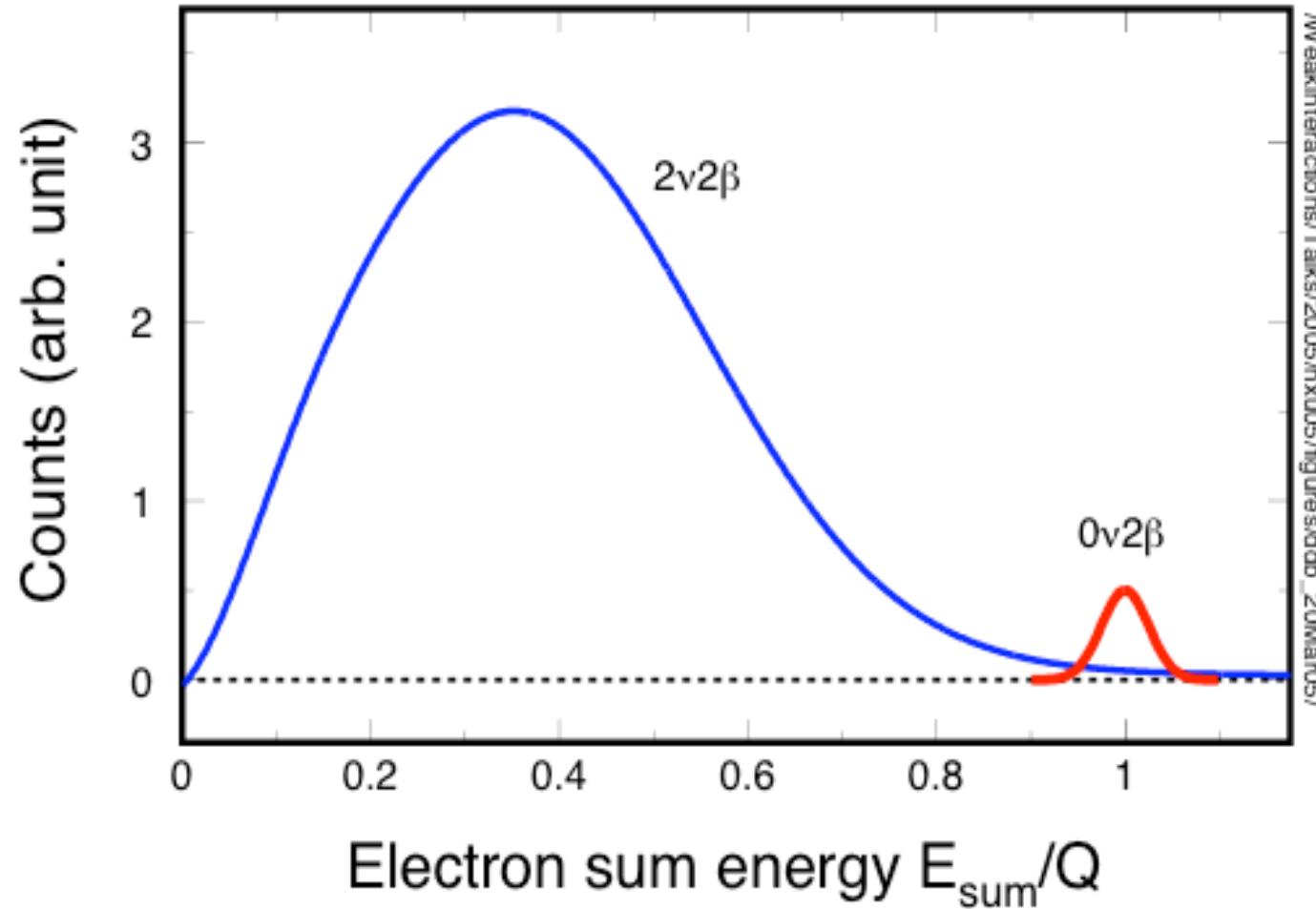
Phase space integral

Neutrino mass

$$\left[T_{1/2}^{0\nu} \right]^{-1} = G^{0\nu} * |M^{0\nu}|^2 * \langle m_\nu \rangle^2$$

Nuclear decay matrix elements Large model uncertainties

Double beta decay

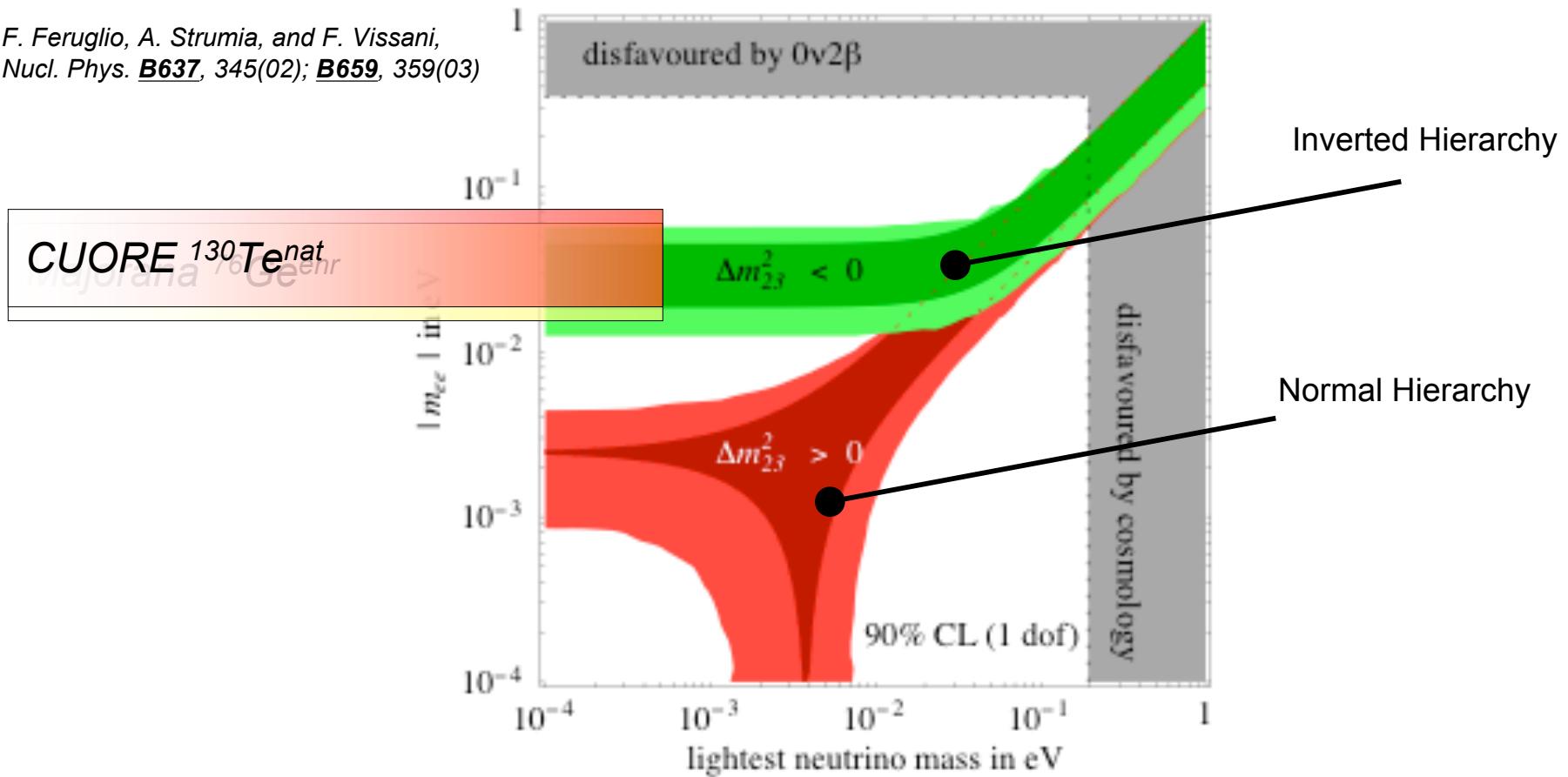




Next generation 0ν2β experiments



F. Feruglio, A. Strumia, and F. Vissani,
Nucl. Phys. **B637**, 345(02); **B659**, 359(03)



- (1) Cuoricino current limit : $1.8 \times 10^{24} \text{ yr.}$; $|\langle m_\nu \rangle| \sim 0.2 - 1 \text{ eV.}$
- (2) CUORE: $\sim 2 \times 10^{26} \text{ yr.}$; $|\langle m_\nu \rangle| \sim 8 - 45 \text{ meV.}$

CUORE/CUORICINO: *PRL95*, 142501(05); *hep-ex/0501010*



The US-CUORE Collaboration



Responsibilities:

- (1) NTD: LBNL UCB
 - (2) TeO₂ crystals: LBNL, LLNL
 - (3) Front end electronics: SC, UCLA
 - (4) Data analysis: LBNL, UCB, UCLA
 - (5) Low background counting: LBNL, LLNL, UCB
 - (6) *Source calibration: LBNL
 - (7) *Suspension system: LBNL

What we are doing:

- (1) Forming a strong US collaboration - well on the way
 - (2) Searching for funding from NSF and DOE

Time line: (Nu's wish)

- (1) Funding starts in fy07 by NSF and/or DOE
 - (2) NTDs production: starts fy06, finish fy08
 - (3) Crystals purchasing: starts fy07, finish fy09
 - (4) CUORE assembly: fy09 - fy10